

Federal Aviation Administration

National Airspace System Capital Investment Plan 2006 - 2010

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Federal Aviation Administration National Airspace System Capital Investment Plan for Fiscal Years 2006–2010

1 Introduction

1.1 What Is the Capital Investment Plan?

The Federal Aviation Administration (FAA) Capital Investment Plan (CIP) is a 5-year plan that describes the National Airspace System (NAS) projects that can be funded within the Office of Management and Budget future-year targets over the 5-year period, 2006 to 2010. The CIP fulfills FAA's obligations under P.L. 108-447 to "… transmit to the Congress a comprehensive capital investment plan for the Federal Aviation Administration which includes funding for each budget line item for fiscal years 2006 through 2010, with total funding for each year of the plan constrained to the funding targets for those years as estimated and approved by the Office of Management and Budget."

The CIP is based on the NAS Architecture and priorities set by the FAA capital investment team. The NAS Architecture defines the services provided by the FAA and the systems necessary to provide those services, such as radars, navigation systems, and air traffic control automation. The capital investment team ranks the CIP programs that fund these systems using FAA Flight Plan goals and estimates of the programs' economic value to establish program funding. The capital investment team also puts a high priority on fully funding projects with funding baselines approved by the FAA Joint Resources Council

The CIP includes planned expenditures for the current fiscal year budget and for each of the next 4 years for each line item in the Facilities and Equipment budget. The project descriptions and funding levels in the CIP are a comprehensive summary of how much system modernization we will do in the next 5 years.

The Flight Plan 2005–2009 is the FAA's new strategic plan. It contains the broad strategic goals that define the fundamental purposes of the agency. Under each goal are several objectives, strategies, and initiatives that articulate the actions the FAA believes are necessary to accomplish those goals. Each objective also has one or more measurable performance targets. These targets set a specific level of achievement in a specific time frame to meet the objectives.

Consistent with the President's Management Agenda, the projects in the CIP have been linked to a goal and objective. The list of goals, objectives, and the related projects appear in Appendix A. Normally, several projects are grouped under a single objective and its related performance targets. This is because in a complex system such as the air traffic control system, many projects are needed to meet the objectives and their related performance targets. In addition, many projects are interdependent, and one project could not affect the performance target without other supporting projects.

1.2 The Capital Investment Plan Is Necessary To Manage Long-Range Projects

Because it takes several years to implement many projects, we must plan for future-year resources to ensure that we complete projects and deliver the expected benefits. In addition, we must continue to balance future-year spending between initiatives and sustaining the existing infrastructure because efficient operations depend on sustaining the high performance of existing equipment until we can install more modern systems.

Because of the legislative caps on future-year CIP estimates, Appendix C includes only projects that are likely to receive funding. The CIP does not include other initiatives that were considered but rejected because they would require funding above those caps. As a result, the CIP gives a clear picture of the pace of modernization and how well improvements to the air traffic control system are keeping up with industry growth.

1.3 The CIP Supports the Air Traffic Organization

The FAA established the Air Traffic Organization (ATO) February 8, 2004, and air traffic services and supporting functions are now operating within the ATO. A single ATO Business Plan has been developed to guide the operation of the ATO. The Business Plan serves two purposes: (1) to align the goals of the ATO with the strategic goals of the FAA Administrator, the Secretary of Transportation, and the President and (2) to provide a blueprint for ATO strategies and initiatives over the next 5 years. Operating and Financial Plans have been developed to support the goals in the Business Plan. The ATO executives will commit to carrying out these plans, so the objectives of the Business Plan can be met.

Most of the capital investment projects support ATO functions, and the CIP is an integral part of ATO financial planning. With reduced funding available from the aviation trust fund, the ATO will have to allocate a larger portion of capital investment toward more efficient operations and reduce the portion directed toward increasing capacity to meet growing demand. Investment to accommodate growth will have to be carefully focused on locations, which will benefit the most from expanded capacity. The CIP also contains projects that support FAA organizations outside the ATO. Most of these capital investments are directed at improving safety programs by modernizing the databases used to track safety performance.

The challenge for the future will be how to achieve a balance among the competing needs for improving efficiency, expanding capacity, and sustaining the reliability of existing systems. Improving efficiency will require improvements to existing equipment as well as using new technology. It holds the promise of improving capacity at a lesser cost, but it will not solve all capacity problems. The FAA must invest in some new facilities, and it also must ensure that operations with existing equipment remain reliable. Sustaining existing equipment will consume a significant portion of capital investment. The installed base of FAA facilities and equipment has an estimated value of about $35 billion. We estimate that approximately $2 billion per year is necessary to maintain existing system reliability and availability.

Successful management of the ATO depends on setting priorities for spending that recognize today's operating environment. We have developed a strategic management process to provide guiding principles for achieving the needed efficiencies and providing the high quality services that our customers expect. Key strategic principles for managing the ATO are:

- Achieve operational excellence
- Enhance financial discipline
- Increase capacity
- Ensure Viable Future

2 Other Planning Efforts Complement the CIP

2.1 The FAA Aerospace Forecast Projects Future Workload

Each year, the FAA Aerospace Forecast projects aviation activity and demand for FAA services for the next 12 years. This forecast is a key planning consideration for FAA system engineering efforts in determining the investment necessary to sustain the air traffic control system. The forecast information enables the FAA to determine system improvements needed to address expected overall growth and changes in the tempo of operations at key airports. As air traffic at busy airports increases, the FAA will also have to deal with the added complexity caused by the increased operations.

Commercial air travel in the past 20 years has more than doubled. We expect this long-term growth trend to resume as the overall economy improves this year and next. Total U.S. commercial air carrier capacity and air traffic exceeded pre-September 11 levels in 2004, and the FAA expects domestic air travel to reach fiscal year 2000 levels during 2005, and then resume more normal growth rates. Instrument Flight Rule (IFR) activity at FAA en route centers exceeded 2000 levels in 2004, and IFR operations at towers are expected to reach pre-September 11 levels in 2007. During 2004, delay has been creeping back into the air traffic system, and, more significantly, delay at a few large hubs is often reflected into the system and affects other airports. In 2004, commercial activity at 17 of the 35 busiest airports identified in the Operational Evolution Plan (OEP) exceeded the 2000 activity.

Projections of continued growth in air travel and FAA workload are based on several factors, including economic growth, low cost fares and increased pleasure travel. Despite unprecedented high fuel prices, the U.S. economy has exceeded 3 percent real growth for the last four quarters. Since air travel correlates highly with economic growth, the number of airline trips is likely to increase proportionately with general economic growth. Expansion in the number of markets served by low-cost carriers has also increased the demand for air travel by reducing the cost of air travel for both leisure and business travelers. The aging of the U.S. population supports an increase in demand for pleasure travel.

More importantly, the impact on FAA workload will be greater because the relationship between the number of passengers handled and the number of aircraft operations, which determines the FAA workload, has changed significantly since September 11. The rapid growth of low-cost carriers, the expanded use of regional jets in markets previously served by larger jets, and increased point-to-point service have resulted in both a change in the mix of aircraft operating in the air traffic environment and more growth in aircraft operations than historical trends would have predicted. Significantly larger numbers of smaller aircraft have increased the complexity of the workload by creating a greater strain on existing capacity and presenting new operational challenges.

2.2 The Concept of Operations Recommends Future Air Traffic Control Capabilities

The FAA and the aviation industry jointly developed the RTCA NAS Concept of Operations and Vision for the Future of Aviation (Conops). The Conops details the consensus view of what air traffic control capabilities should be available in the future. This vision recommends a future air traffic control system that will allow all customers to operate without undue constraint in a system that enhances today's high level of safety while providing equitable access. The operating capabilities outlined in the Conops build the conceptual framework for designing the systems and operating procedures that will be used in future years. These capabilities drive the specific planning in the NAS Architecture, and they translate projected new capabilities into engineering designs necessary to achieve them. The strength of the Conops is that it represents a joint effort to identify the steps necessary to ensure industry needs will be met.

2.3 The NAS Architecture Details NAS Systems and Services

The NAS Architecture is closely tied to the Conops. The Conops drives operational improvement evolution, and that drives the design of future infrastructure. The Conops describes how air traffic services can be improved to operate more efficiently. The NAS Architecture then translates those improvements into tangible equipment decisions that are consistent with engineering decisions on overall system configuration.

The NAS Architecture is a Web-based information system that describes the systems and services provided for the NAS. The highest level of the architecture lists services provided to aviation customers. These services are used to define the subcategories of mechanisms and components necessary to provide them. Details are included in the NAS Architecture to show current capabilities for these systems, and the plans for how they will change over the next 15 years. The NAS Architecture also identifies the interfaces between systems, which can be used to determine what systems will be affected when a change is made to a mechanism or component.

2.4 The FAA Operational Evolution Plan and Airport Capacity Enhancement Plan Recommend Capacity Improvements

The FAA Operational Evolution Plan (OEP) is the primary internal plan for improving capacity over a10-year rolling timeframe at the 35 most congested airports. The OEP analyzes the causes of delay and develops potential solutions that can be completed within the 10-year timeframe. The OEP is coordinated with aviation customers and reflects their views on the most promising ways to increase capacity and decrease delays. In support of recommendations in the OEP, the FAA regions develop Runway Template Action Plans, which are detailed project plans for supporting construction of new runways.

The Airport Capacity Enhancement Plan is a complementary FAA plan that collects data on 100 airports and shows planned and recommended airport projects that would improve capacity and reduce delays. Airport improvements, recommended in the Capacity Plan, normally receive financial support from the airport grant program, but the NAS equipment that enables full use of airport improvements is provided by CIP projects. The OEP projects can be either operational improvements or equipment installations supported by projects in the CIP.

2.5 Joint Planning and Development Office Plans Long-Range Aviation Needs

The FAA reauthorization legislation, titled Vision 100 — Century of Aviation Reauthorization, required the Secretary of Transportation to establish an FAA Joint Planning and Development Office (JPDO) to manage work related to the Next Generation Air Transportation System. This office coordinates with a coalition of government agencies to study the needs of the aviation system of the future. The government agencies include the Departments of Transportation, Defense, Homeland Security, and Commerce, National Aeronautics and Space Administration and the White House Office of Science and Technology Policy. The JPDO is evaluating future air traffic demand and the systems needed to accommodate that demand with minimal delay. It has been developing the broad principles that should be followed in designing the system for the future, and it will continue work on a more detailed long-term plan for system modernization. This long-range view of aviation services will serve as a road map to the future and will be integrated into the NAS Architecture within the financial caps specified for future- year funding.

3. FAA Faces Significant Challenges in Planning

The changing fleet mix for commercial carriers is significantly impacting the amount of revenues flowing into the Airport and Airway Trust Fund. With an increasing number of low-cost operators and use of regional jets to serve smaller markets, the average number of passengers per aircraft and the amount of revenue per passenger are declining. At the same time, aircraft operations and the resulting demand for air traffic services are increasing. The result is that fewer resources are available for capital improvements, but the FAA must accommodate a growing demand for services. Because of these conditions, the FAA must structure its choices to focus on the most productive ways to increase capacity while also improving efficiency of operations.

The following principles guide our allocation of capital investment dollars:

- Preserving the FAA's enviable safety record
- Building a sound infrastructure and adding new capabilities to better serve our customers
- Carrying out our mission more efficiently
- Managing our costs and increasing productivity

Every investment must first meet the test of either preserving safety or improving it. Priorities for other investments are changing in the current economic climate. We must ensure that we can sustain present performance before we invest in expansion. As systems age, performance declines and maintenance costs increase. This increases operating costs, and the resulting system outages can cause delays at major airports. We will direct most new investment at sustaining the

current infrastructure to ensure that air traffic services remain reliable and delays are minimized. A smaller portion of the funds available will be spent on providing new capabilities.
The following sections outline how capital investment supports these strategic principles and give examples of the initiatives to achieve them.

3.1 Preserving FAA's Enviable Safety Record

Air travel on U.S. commercial airlines has an impressive safety record, and we must both maintain that record and improve it. Several projects will address known safety problems to prevent accidents from happening. The following projects are the key initiatives to improve safety and preserve the confidence travelers have that their journeys will be safe.

3.1.1 Surface Surveillance Systems

Surface surveillance systems support the safety initiatives described in the FAA Flight Plan to reduce runway incursions. To prevent accidents on airports runways and taxiways, air traffic controllers need to have precise information on the location of aircraft and other vehicles in the airport operating areas. These systems are especially valuable in decreased visibility conditions and in locations where tower controllers cannot see some parts of the runways and taxiways. The major effort in this program is to increase the number of airports with surface surveillance, but funding is also provided for upgrading existing systems. A longer-term goal is to give pilots displays of ground traffic information and a moving map of the airport surface. This will improve pilot awareness of their location on the airport surface and help them follow controller instructions.

To protect against runway incursions at busy airports that do not already have airport surface surveillance systems, the FAA is installing the Airport Surface Detection Equipment – Model X (ASDE-X). This system uses advanced technology to detect aircraft and ground vehicles in the airport operating area. The ASDE-X uses a triangulation technology based on aircraft transponder responses to pinpoint the exact position of aircraft and vehicles. We will deploy ASDE-X at 25 operational sites.

3.1.2 Safety Databases

The Aviation Safety Analysis System (ASAS) and its two follow-on projects—the System Approach for Safety Oversight (SASO) and the Aviation System Knowledge Management Environment (ASKME)—are safety databases that provide detailed information to aviation safety inspectors. These databases contain records of safety infractions for pilots and air carriers; the text of safety regulations governing operation, manufacture, and repair of aircraft; and the text of directives and the compliance records for commercial operators. Having this information readily available ensures the inspectors are aware of the past safety compliance of the persons and organizations being reviewed. It also increases the effectiveness of the inspectors and ensures that they have the latest information about FAA regulations and Advisory Circulars when they conduct inspections.

3.1.3 Integrated Flight Quality Assurance

The Integrated Flight Quality Assurance (IFQA) program provides a way for air carriers to transfer information gathered from flight data systems in an aircraft to a centralized database so that it can be examined for safety issues. Many airlines have used this data to identify nonstandard practices in approaches and landing so that they can develop practices that improve safety and reduce the fuel consumed on approach and landing. The FAA will use this data and incorporate additional data from the Aviation Safety Action Program to discover operational safety issues and promote safety improvements through FAA policy and decision-making.

3.1.4 Safety Management System

The Safety Management System (SMS) is a disciplined approach to analyzing safety issues that may arise in the design and use of FAA equipment and procedures consistent with international standards. The program requires a rigorous review of new equipment designs early in the acquisition process to identify safety issues. The safety analysis results in recommendations to integrated product teams that manage development of new equipment, to help them redesign the equipment to remove or lessen any safety problems that have been uncovered. The same process is used for new procedures or operational changes to ensure the proposed changes will improve safety.

3.2 Building a Sound Infrastructure to Better Serve Our Customers

Operation of the air traffic control system requires both modern facilities and sophisticated supporting equipment such as radars, navigation aids, and communication equipment. Outages of a single component at or near a large airport can cause delays costing millions of dollars. There are 21 en route centers and just under 500 towers and TRACON facilities (both FAA-operated and contract) in the National Airspace System. Surveillance information from more than 300 radars provides controllers accurate displays of aircraft location at those facilities. More than 2,000 navigation and precision landing systems enable pilots to follow the routes they have told FAA that they will fly and land safely in reduced visibility conditions. About 3,000 remote communications sites enable pilots to stay in voice contact with air traffic control facilities. In addition, there are automation systems, weather sensing systems, and other supporting systems that make air traffic control possible. The FAA estimates that more than 40,000 individual pieces of equipment are necessary to operate the U.S. air traffic control system. Examples of some of the most important replacement programs follow.

3.2.1 Tower and Terminal Radar Control Facilities Replacement and Modernization

Figure 1. Airport Traffic Control Tower

Every year, the FAA for various reasons replaces or modernizes a portion of the air traffic control towers at airports. Some currently operating towers were built more than 40 years ago and fall far short of modern standards for an efficient workplace. Some towers requiring replacement are at airports that have built new facilities to accommodate growth in passenger travel and air cargo shipments, and sight lines to the runways have become obscured. To improve safety, the tower must be built taller to ensure full visibility of the runways and taxiways.

When obsolete equipment is replaced in a tower or terminal control facility, the existing tower cab and terminal radar control (TRACON) facility may need to be upgraded. Finally, increases in air service may require expansion of control facilities to accommodate more controllers and their workstations. This is especially true when new runways are opened at an airport and the resulting increase in traffic requires more traffic control positions to be opened. In a typical year, the FAA will have up to 20 projects ongoing to replace existing air traffic control towers and TRACON facilities.

3.2.2 Voice Switches

The FAA installs voice switches in air traffic control facilities to enable controllers to send and receive messages from (1) remote radio sites that transfer messages to and from pilots; (2) other controllers within their facility; and (3) controllers in adjacent facilities. The voice switches route all these communications from incoming and outgoing lines to a panel at the controllers' positions; so a controller can select the voice channel he or she needs to speak with pilots or other controllers. Controllers and facility staff also need to be able to use normal telephone lines to communicate with parties in the local area such as emergency services personnel and aviation customers.

The FAA is developing a business case to replace the 16 existing types of voice switches with a standard switch scaled to the size of the facility where it will be used. Operations and maintenance costs for the existing switches are increasing due to the age of the switches, the cost of obtaining spare parts, and the difficulty in finding experienced personnel to maintain these older technology switches. In addition, these switches will not support future NAS capabilities such as airspace redesign, dynamic resectorization, digital communications, heightened security, and remote maintenance monitoring.

3.2.3 Terminal Radars

The FAA is completing the process of replacing older terminal radars (mainly Airport Surveillance Radars – Models 7 and 8) that are 20–30 years old with the newer Airport Surveillance Radar – Model 11 (ASR-11). This new radar provides data to terminal air traffic control facilities in a digital format as required by the Standard Terminal Automation Replacement System (STARS), which is replacing existing obsolete automation systems. The initial replacement program, which is the ASR-9, began transition to a digital format, and the ASR-11 will complete replacement of the older terminal radars now in service.

Figure 2. ASR-11 Radar System

The ASR-9 is compatible with STARS, and it is in operation at about 120 airports. Installations began in the late 1980s, and this system requires a service life extension program (SLEP). The SLEP replaces transmitter and receiver components that have high failure rates and improves the antenna drive system. By replacing these key components, the FAA will extend its operational life and reduce existing maintenance costs. This program is especially important because the ASR-9 provides surveillance data for the larger airports where outages are costly.

3.2.4 Terminal Automation Systems

The FAA operates 170 terminal radar control (TRACON) facilities. These facilities control air traffic as it transitions from en route control to the approach zones for airports and from departure paths around airports to en route control. The automation systems installed in the TRACON facilities show aircraft position on controllers' displays. The FAA has approved a program to replace 51 of these systems and is studying alternatives for replacing the remaining systems.

Figure 3. Standard Terminal Automation Replacement System

The FAA has installed STARS at 29 of the 51 approved locations. The new system can accept additional automation aids, and it improves controller displays by adding six-color weather depiction. It also has an improved backup system that is independent of the STARS software.

3.2.5 En Route Facilities Modernization

Figure 4. En Route Center

Most of the 21 Air Route Traffic Control Centers (ARTCC) and the Combined Center Radar Approach Control (CERAP) facility at San Juan, Puerto Rico, were built in the early 1960s and over the years have been expanded and modernized in phases. However, much of the mechanical and electrical equipment in these facilities is old and requires replacement to reduce the risk of an air traffic control service interruption. In addition, many areas in these facilities do not meet current standards for handicapped accessibility, and there is a continuing need to remove asbestos fireproofing materials installed when the facilities were built. Condition assessment surveys show that there is a backlog of facility improvements that should be funded. The risk of not keeping up with facility maintenance projects is that repairs will be made on an emergency basis and thus cost substantially more. There is also a risk of loss of service. For example, a fire in 2001 at the Cleveland ARTCC resulted in an evacuation of the control room, diversion of all en route air traffic around the center airspace, and loss of air traffic control services for 16 minutes in the sectors controlled by the Cleveland ARTCC.

Examples of the projects performed with this funding are: (1) replacement of obsolete electric power distribution systems; (2) replacement of heating, ventilation, and air-conditioning systems; (3) fire-detection and prevention upgrades; (4) asbestos abatement; and (5) interior construction to provide space for new equipment.

3.2.6 En Route Automation Systems

The Host Computer System, which is the central component of the en route automation system, will be difficult to maintain after 2010. Operational availability and maintainability will be at risk, if it is not replaced. En route automation system outages at individual centers during peak travel times can create a ripple effect that results in long delays or cancellations. Also, automation improvement provides an opportunity to achieve productivity and efficiency gains without significant increases in controller staffing that are necessary to deal with forecasted growth in operations. Current system hardware and software limitations are progressively impeding the ATO's ability to accommodate the increasing demand for air traffic services.

Figure 5. En Route Control Display

The En Route Automation Modernization (ERAM) Program replaces the Host Computer, its backup systems, and portions of the display system infrastructure, which includes the technical refresh of the radar position processor. The ERAM backup system simplifies system maintenance and eliminates the need for air traffic restrictions if there is a primary system failure. The current Host has technological and structural restrictions, which include limits on the number of flight plans that can be stored, the number of radars that can be used, and flexibility in airspace configuration. ERAM will have capabilities that minimize these restrictions.

The ERAM architecture and deployment plans assume successful implementation of other projects included in the ERAM Program. The new En Route Communications Gateway (ECG) replaced the Peripheral Adaptor Module system, and it provides a modular and expandable communications network to support ERAM. The En Route Modification program replaces obsolete display processors and upgrades air traffic control consoles to address maintenance issues with existing systems.

In coordination with other en route programs, ERAM will enable a smooth transition from the current system to a modernized en route system architecture without affecting critical services. The upgraded system architecture will provide improved capabilities and facilitate implementation of future improvements. These improvements will provide more efficient routing for aircraft in the en route domain. ERAM will reduce maintenance costs for both en route hardware and software. The newer hardware will have fewer failures. The modern programming language used for the software will make it easier to maintain the software.

3.2.7 Navigation Systems

The FAA faces difficult decisions regarding the future mix of ground- and space-based navigation systems. It would be desirable to replace existing ground-based systems with a system less costly to maintain, but we must continue to provide existing navigation services until a satisfactory solution is accepted. The longer it takes to agree on acceptable alternatives to ground-based systems, the greater the cost will be for maintaining dual capabilities. The current systems define the most commonly used routes in the air traffic control system. They also provide other services such as a communications link to broadcast weather conditions to pilots in flight. They provide precision guidance to airports in low-visibility conditions, which improves schedule reliability for commercial carriers. Efforts are underway to take advantage of new satellite navigation technology, but users must equip and procedures must be developed before the number of existing systems can be reduced.

The Very High Frequency Omnidirectional Radio (VOR) navigation system provides position information for aircraft in flight. The Distance Measuring Equipment (DME) system can also be used for in-flight position and guidance for nonprecision approaches to airports. Both systems require consistent annual levels of reinvestment to sustain current levels of service.

In 2003, two new runways became operational. The FAA Flight Plan sets a target of opening seven more new runways by 2009. New runways require precision landing guidance to maximize the potential increase in capacity at busy airports. Instrument landing systems, runway lighting, and visibility sensors make runways usable in low-visibility conditions when the added capacity is most needed.

A candidate for providing future navigation services is the Global Positioning System (GPS), a satellite navigation system that can be used to determine precise position information. The 24-satellite system provides worldwide coverage with high accuracy. There are concerns, however, that must be resolved before this system can be used for aviation. Pilots must have assurance that there are not any significant errors in the information that they are receiving from the satellites. Augmentation is needed to provide information on reliability of the signal and to provide precise corrections to the satellite signals.

The Wide Area Augmentation System (WAAS) uses more than 20 ground stations to determine precise corrections to the satellite signals, detect unusable satellites, and send that information via communications satellites to aircraft receivers.

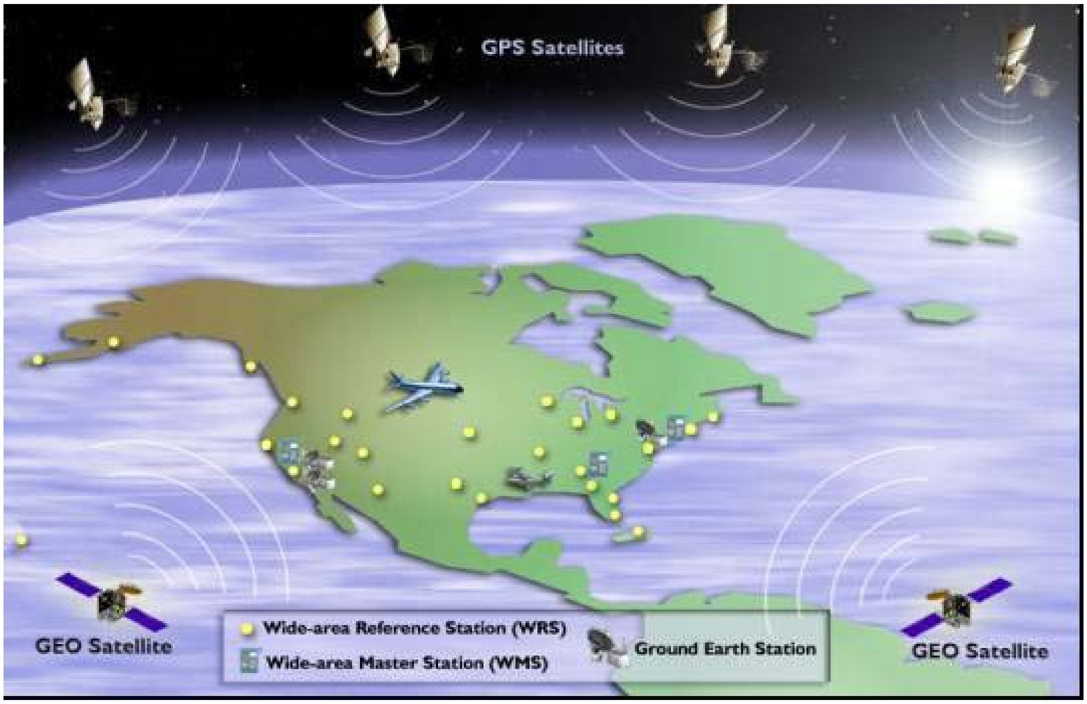

Figure 6. Wide Area Augmentation System

The corrected GPS information can then be used for landing guidance during adverse weather, when proper procedures are developed and the aircraft is equipped with the necessary instrumentation. The WAAS is operational, and we continue to develop procedures to allow landings at airports that do not have instrument landing systems. The GPS signal can also increase navigation coverage at low altitudes because it provides accurate position information for pilots flying in areas where the VOR signal is blocked by terrain.

3.2.8 Security of the National Airspace System Infrastructure

As threats to security have increased, the FAA has had to devote substantial additional resources to programs that improve both facility and information system security for the air traffic control system and related infrastructure. FAA employees and the facilities they work in are essential in supporting the smooth flow of air travel. Even small disruptions can cause major economic loss to both commercial air carriers and air travelers.

The Facilities Security Risk Management (FSRM) program assesses the physical security risks for staffed facilities and funds improvements to correct security issues. Efforts are directed at identifying any inadequacies in protective systems for staffed facilities and ensuring that all steps are taken to prevent facility intrusions and facility damage. The recommended actions are consistent with guidelines established by the Department of Justice for the physical security of government buildings.

The air traffic control system depends on computer automation and relies on elaborate communication systems to keep the system running. All systems must be analyzed for vulnerabilities and have protections installed to prevent system intrusion and disruption. We use the FAA's Android Cyber Defense Model to accomplish this. The model strives to emulate the defenses and resiliency of the human body against attack by infection and disease. It includes hardening systems, boundary protection, informed recovery, systematic monitoring, and orderly quarantine.

The FAA's achievements to date include certification and authorization of air traffic control systems, intrusion detection monitoring, and simplification of the architecture to address system protection. Future activities include remediation of system vulnerabilities discovered during the certification and authorization process and vulnerability reviews, implementation of the NAS Information Systems Security Architecture, and implementation of adaptive quarantine to isolate infected systems from non-infected systems.

3.3 Carrying Out Our Missions More Efficiently

To handle future growth within expected future resources, we must find ways to more efficiently use existing systems and airport capacity. The following sections highlight some of the programs that increase efficiency of operations.

3.3.1 Free Flight Programs

The Traffic Management Advisor (TMA) program is an automation aid that enables en route and terminal facilities to coordinate traffic flows before they reach terminal airspace. This maximizes use of landing slots at an airport because en route facility personnel can properly space aircraft before they enter terminal airspace, and the terminal controllers can optimize the flow of aircraft landing on available runways.

The User Request Evaluation Tool (URET) is another automation aid, and it enables controllers to check a requested change in the intended path of flight for an aircraft to determine if any conflicts would occur. When pilots request direct routings to save time and fuel, the controllers can use URET to determine whether and when they can approve the requested change. Controllers can also use URET to determine the feasibility of alternate routes when adverse weather requires pilots to alter their planned routes of flight to avoid thunderstorms or turbulence. Reducing flight route length saves direct operating costs and fuel.

3.3.2 Traffic Flow Management (TFM) Modernization

The Traffic Flow Management (TFM) system is used for strategic and tactical planning to accommodate heavy traffic flows. Traffic Management Units at terminal facilities coordinate with flow management units at en route centers to determine when demand may exceed capacity. The terminal and en route units, in consultation with the Air Traffic Control System Command Center, jointly decide on strategies to prevent excessive system delays. The TFM system has sophisticated software applications that compare capacity and demand using real-time information on aircraft in flight. It provides a clear picture of potential congestion and helps in assessing alternatives to handle high demand. The hardware used for TFM is becoming obsolete and lacks the necessary capacity for further improvements in management of air traffic. Funding has been approved to replace the hardware, and a decision is pending on how much funding to allocate for software upgrades.

3.3.3 Communication Facilities

An essential function for air traffic control is to enable air traffic controllers to talk to pilots. Since many air traffic facilities cover areas that are larger than the range of the radios used to communicate with pilots, remote radio sites are installed to send and receive those communications. There are about 3,000 of these remote sites used nationwide. As air traffic patterns change and airlines change route structures to provide new services, either a new remote site must be added or existing sites must be relocated.

In heavy air traffic areas, many radio frequencies reserved for FAA use are fully allocated. The FAA expects that further growth in aircraft operations will require more communication channels to ensure that critical messages can be exchanged between controllers and pilots. It is unlikely that radio frequencies outside the bands allocated to the FAA will be available for aviation use. The FAA is exploring new technologies to accommodate the increasing need for more channels to meet air traffic service requirements. The transition to a new technology or technologies will take several years because of the installed base of existing equipment, but solutions must be pursued now to prevent limits on future growth.

In fiscal year 2004, in recognition of the need for international harmonization on the best technical solution to the spectrum congestion problem, the FAA decided to defer developing and implementing the ground component of the Next Generation Very High Frequency Air/Ground Communication (NEXCOM) system. However, there is agreement that if the problem is not addressed, we could experience limits on air traffic services by 2015.

The FAA is continuing to field its new multimode digital radios, and it is continuing development of compatible avionics to help airline and business jet operators prepare for implementation of new technology. The lead times for equipage for these operators are longer than that required for FAA ground infrastructure modernization.

The FAA and Eurocontrol are partnering in a 3-year joint Future Communications Study to define a global air/ground communications system that will accommodate the increasing growth in air traffic and provide worldwide interoperability among all air traffic service users. We expect that this study will result in a globally harmonized communications system that will begin service in the high-altitude en route airspace by 2015 and provide benefits to all airspace users through 2030 and beyond.

3.3.4 Oceanic Air Traffic Control

Transoceanic travel is growing faster than domestic travel, and the increasing tempo of operations is resulting in operational inefficiencies.

Figure 7. Oceanic Automation System

Many aircraft are unable to immediately climb to their most efficient operating altitudes, so they consume extra fuel. In addition, current limitations affecting the precision of information on aircraft location requires controllers to provide as much as 100 miles separation between aircraft. This results in longer routes and increases the flight times for oceanic flights, which increases fuel consumption. The new oceanic automation system, coupled with better communications and better aircraft position information, will increase the precision in oceanic air traffic control. This will allow reduced miles of separation and quicker approval of preferred altitudes.

3.3.5 Terminal Weather Information

The FAA will install the Integrated Terminal Weather System (ITWS) at 22 TRACON facilities and provide weather information to 28 airports. The system integrates the information from several weather sensors and provides a composite picture of the weather around busy airports. The system is also able to project movement of weather systems 20 minutes into the future. Tower managers have stated that this system results in a reduction in delays and diversions due to severe weather near an airport. By having accurate weather information, air traffic managers are able to keep airports open longer and reopen them sooner after thunderstorms and other severe weather have passed the operating area. The system is also used to decide when to shift traffic flows to different runways for takeoffs and landings when there is a change in the wind direction over the airport. Advance notification of these changes allow controllers to direct aircraft to the most efficient approach routes rather than having to redirect them from their an approach path to a runway that will no longer be used.

3.4 Managing Our Costs and Improving Productivity

In addition to improving the efficiency of air traffic operations to better serve our customers, the FAA must carefully manage its own internal costs. The FAA must allocate a portion of its capital investments to projects that lower its operating costs. This section highlights some of the projects that we have justified based on their potential to reduce the cost of operations for the FAA.

3.4.1 Federal Telecommunications Infrastructure (FTI)

The Federal Telecommunications Infrastructure contract provides commercial telecommunications services to support both voice and data communications among FAA facilities and to and from FAA headquarters. This contract uses an integrated approach to improve delivery of services. Costly legacy networks will be replaced by modern, reliable, and consolidated network infrastructure incorporating multi-service and multi-media capabilities at low cost. This contract is projected to save the FAA about $500 million over a 10-year period.

3.4.2 National Airspace System Infrastructure Management

The National Airspace System Infrastructure Management System (NIMS) program is designed to increase the efficiency of maintaining FAA systems. It relies on remote maintenance monitoring to minimize travel of maintenance technicians, and it uses software to facilitate new business practices by improving information collection and sharing. Workload information is analyzed to determine the total amount of staffing for maintenance functions and to decide on allocation of staffing to FAA facilities. Historical maintenance data provides the maintenance technician information on previous equipment failures and successful solutions, so repairs can be accomplished in a shorter period.

3.4.3 Supply System Management

The Asset and Supply Chain Management (ASCM) system improves management of FAA assets and inventory. It replaces 12 existing legacy information systems. Using bar coding and automated inventory control equipment, the system will increase accountability and control of repairable parts and expendable inventory. By exerting tighter control, it will decrease the amount of inventory purchased and increase visibility and subsequent use of existing inventory

3.4.4 Distance Learning

The Distance Learning Program enables the FAA to provide instruction to FAA employees at their workplace rather than bringing them to the FAA Academy in Oklahoma City. We mostly use computer-based instruction to provide distance learning. Employees can take courses at their worksite and use interactive media to learn about new equipment and procedures being introduced into the NAS. One significant benefit is lowering the cost of student travel and per diem compared to the costs for resident training. In addition, distance learning increases training opportunities for FAA employees and minimizes time away from their worksites.

3.4.5 Competitive Sourcing

As part of the President's Management Agenda, the FAA has been examining opportunities for competitive sourcing. The flight service station program met the criteria and competitive bids were solicited to determine the most cost effective mechanism for providing these services. One of the criteria was that proposals would have to show cost savings of at least $1.0 billion over ten years. The FAA evaluated five competing service providers, including the existing FAA organization to determine which offered the best value to the government. A contact has been awarded to provide these services and the new provider will assume operations in October 2005.

4 Conclusion

The FAA faces major challenges in dealing with growth in operations while sustaining the large capital base already in place. Growth is returning, and pressure on large airports will require more sophisticated management of air traffic activity. Yet, revenues into the trust fund will not reach the levels predicted a few years ago. More rigorous management will be required for capital investment funds, and decisions on project funding will have to carefully balance initiatives against sustaining the present system. The comprehensive ATO Business Plan addresses these issues. However, it must also consider the vision for the future contained in the recommendations of the Joint Planning and Development Office for the future configuration of the air traffic control system.

A significant consideration in planning is recognizing that the high standards of performance for FAA equipment and automation systems require lengthy testing and implementation schedules. Capacity cannot be increased quickly. We must consider modernization needs now to ensure that new equipment can be installed and operational when it is needed. The CIP is part of the planning process and contains active projects for 2006 to 2010 to keep the NAS operating successfully. The NAS Architecture addresses both the time frame of the CIP and longer-term planning for system modernization.

One of the useful outcomes of future planning is development of a benchmark for the structure of the air traffic control system beyond 2010. Understanding future demand and the configuration of the system to meet that demand is a critical step in determining how to proceed with system modernization; and it improves the accuracy of estimating the resources to meet that vision of the future. The CIP information and the NAS Architecture complement each other in that role and set the stage for an informed dialogue on the pace and content of our future modernization efforts.

5 Appendices to the Capital Investment Plan

The CIP contains four appendices:

Appendix A

- Lists FAA strategic goals, objectives, and performance targets
- Associates CIP projects with strategic objectives and performance targets

Appendix B

- Provides CIP project descriptions and relationship of project to strategic goals
- Lists FY 2006–2010 — Performance Output goals

Appendix C

- Provides estimated expenditures 2006–2010 by Budget Line Item

Appendix D

- Defines acronyms and abbreviations